

Increasing diversity through broadened distribution of research funding
Northern Illinois University
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Summary:

Historically, the majority of federal research funding has been distributed to a fraction of our Nation's research universities. Students at the remaining universities, including one half of the Nation's underrepresented minorities (URM) students, have limited or no opportunity to engage in research. Participation in research is considered a high impact practice for student retention and graduation and workforce diversification. Promoting partnerships between the two sets of universities will broaden opportunity and diversity while serving the Nation's research needs. This proposal addresses a concern expressed across the spectrum of research universities.

Legislative Proposal:

Insert at the end of the National Science Foundation reauthorization bill text:

"All funding announcements with anticipated grant awards of \$1 million or more made under authorizations in this bill require the recipient to direct at least 10% of the grant funding to building meaningful partnerships with emerging research institutions. Emerging research institutions are defined as institutions of higher education that have less than \$30 million in annual federal science and engineering research and development expenditures as reported by the National Center for Science and Engineering Statistics."

Background:

Taken together, data from two separate sources show that Federal research support is concentrated at a fraction of the Nation's research universities. The concentration presents a structural impediment to diversification. The Higher Education Research and Development (HERD)¹ survey collected and maintained by the National Center for Science and Engineering Statistics (NCSES) at the National Science Foundation provides comprehensive information on national and institution investments in science and engineering. The Carnegie Classification of Institutions of Higher Education² recognizes *very high research doctoral universities* and *high research doctoral universities*. The classification utilizes data from NCSES and the Integrated Postsecondary Education Data System (IPEDS)³ from the Department of Education. Traditionally, and commonly, the two doctoral university classifications are referred to as R1 and R2 universities; all other universities with research programs are traditionally designated R3 universities.

¹ <https://ncesdata.nsf.gov/herd/2018/>

² <https://carnegieclassifications.iu.edu/index.php>

³ <https://nces.ed.gov/ipeds/>

According to the 2018 HERD survey data (the most recent year reported) the 131 R1 institutions received 91.7% (\$32.4 billion) of federal science and engineering research and development dollars. However, IPEDS data shows that those same institutions serve 46.6% of the nation's URM college students, and 52.8% of all college students. Said another way, **over half of our nation's students of color see about 8% (\$2.9 billion) of federal research dollars on their campus**. This leaves the other nearly 300 predominately R2 and R3 institutions listed in the HERD survey with limited research funding and opportunities for over one-half of our URM students. Anecdotally, there is also uneven geographic distribution, with a majority of the R1s located in urban areas and R2s and R3s in peri-urban and rural areas. As a result, students in more rural settings also see less opportunity. These structural characteristics have been evident for decades.

One way to quantify the concentration of federal research resources is to consider the number of awards totaling \$1 million or more made by the National Science Foundation (NSF). These awards often support the creation of new centers, nodes, hubs, or other large-scale research operations. Only 7% of the 33,509 active standard grants and cooperative agreements at the NSF exceed \$1 million. The prevalence of awards of \$1 million or more has increased over time. Nearly 35% of all standard grants and 20% of all cooperative agreements totaling \$1 million or more ever issued by the NSF are currently active, meaning they were likely awarded in the last five years. Looking back over the past two decades, the NSF budget has doubled since fiscal year 2000 while the number of awards over \$1 million has tripled during the same time period, so the concentration of resources in large grants is increasing faster than the NSF budget. This tracks with the trends seen in federal policymaking, where there is increasing interest in deploying federal research resources to create large new hubs, nodes, or centers to address important research topics.

Participation in research is extremely effective for the retention of students and the diversification of STEM fields. Recommendations from The National Academies of Sciences, Engineering and Medicine (NASEM, 2016⁴; 2018⁵; 2019⁶; 2019⁷), National Academy of Engineering (2018⁸) and National Survey of Student Engagement (2016⁹) support URM student research to increase student engagement and foster a sense of belonging and self-efficacy, which, in turn, leads to higher student interest and graduation rates (NASEM, 2017¹⁰, 2018¹¹).

⁴ National Academies of Sciences, Engineering, and Medicine (2016). Quality in the Undergraduate Experience: What Is It? How Is It Measured? Who Decides? Summary of a Workshop. Washington, DC: The National Academies Press. <https://doi.org/10.17226/23514>.

⁵ National Academies of Sciences, Engineering, and Medicine (2018). How People Learn II: Learners, Contexts, and Cultures. Washington, DC: The National Academies Press. <https://doi.org/10.17226/24783>

⁶ National Academies of Sciences, Engineering, and Medicine, (2019). The Science of Effective Mentorship in STEM. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25568>

⁷ National Academies of Science, Engineering, and Medicine (2019). Minority Serving Institutions: America's Underutilized Resource for Strengthening the STEM Workforce. Washington, DC: The National Academies Press. Doi: <https://doi.org/10.17226/25257>

⁸ National Academy of Engineering, (2018). Understanding the Educational and Career Pathways of Engineers. Washington, DC: The National Academies Press. doi:<https://doi.org/10.17226/25284> <https://www.nap.edu/catalog/25284/understanding-the-educational-and-career-pathways-of-engineers>

⁹ National Survey of Student Engagement. (2016). Retrieved from https://nsse.indiana.edu/html/engagement_indicators.cfm

¹⁰ National Academies of Sciences, Engineering, and Medicine (2017). Undergraduate Research Experiences for STEM Students: Successes, Challenges, and Opportunities. Washington, DC: The National Academies Press. <https://doi.org/10.17226/24622>.

¹¹ National Academies of Sciences, Engineering, and Medicine (2018). Indicators for Monitoring Undergraduate STEM Education. Washington, DC: The National Academies Press. <https://doi.org/10.17226/24943>.

Participation in research prepares students to think critically, communicate their ideas, and apply their knowledge in the field (NASEM, 2016⁴) and is identified as a high-impact practice by the Association of American Colleges and Universities (Kuh, 2008)¹².

The concentration of federal research dollars at R1s may provide the expertise and resources for addressing complex problems, however it creates a structural barrier for URM STEM students' participation in high-impact practices. Any proposal must maintain the excellence of the R1s while leveraging the strength of the R1s to broaden opportunity. Both can be achieved by requiring R1 institutions that are hosting new initiatives, research centers, and other large grants to partner with non-R1 institutions.

To fully benefit the nation and broaden participation, these partnerships must ensure that expertise is shared and sustained at the non-R1 institutions. As an example, a quantum information sciences or artificial intelligence center established at a large R1 university could provide fellowships for faculty from their non-R1 partners. Upon return to their home universities these fellows could continue their research and engage students with the support of the R1 center.

Absent legislation requiring structural change, non-R1 institutions with over half our students of color, and nearly half of all U.S. college students, and a strong presence in peri-urban and rural areas will be unable to fully participate in the new research directions under consideration by Congress. Their limited involvement will hamper efforts to diversify opportunity and broaden science literacy. Ensuring partnerships between institutions offers a path forward.

¹² <https://secure.aacu.org/imis/ItemDetail?iProductCode=E-HIGHIMP&Category=>